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BIOLOGICAL EVALUATION OF INSECT DAMAGE AT THE CROWN ZELLERBACH SEED ORCHARD, BOGALUSA, LOUISIANA (1982)

by

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ABSTRACT

A seed orchard scouting program consisting of 9 visits was conducted during the 1982 growing season at the Crown Zellerbach Seed Orchard, Bogalusa, Louisiana. Approximately 1,564 bushels of the 1983 cone crop were predicted to be present in the loblolly seed source as of September 1982. Approximately 79% of the 1983 crop survived from March 1982 to October 1982. Insects were the major identifiable agents causing losses to both cones and conelets. Forest Pest Management (FPM) recommends a pest management strategy consisting of a series of aerially applied foliar pesticide applications.

INTRODUCTION

A seed orchard scouting program was initiated during 1982. This scouting program was designed to:

1) quantify the losses attributed to the major mortality agents
2) determine the periods when major mortality occurs
3) determine the effect these losses will have on the projected cone crop
4) identify areas where modifications could be made to the current pest management strategy to better respond to pest pressures.

A scouting crew from Forest Pest Management (FPM), Alexandria Field Office, monitored damage incidences and pest populations from March to September 1982. During these visits data were compiled confirming that insects are the major identifiable agents causing losses in seed orchards (Overgaard et al. 1974) and, if not controlled, insect pests will

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adversely affect the availability of superior pine seed, thereby reducing future timber production (Barber 1982). Because there continues to be a demand for loblolly seed, Crown Zellerbach personnel are interested in maximizing seed production. Based upon the results of these evaluations, Forest Pest Management recommends significant changes to the current pest management strategy.

METHODS OF EVALUATING INSECT POPULATIONS AND LOSSES

Pest management decisions are dependent upon (I) accurate predictions and assessments of crop production levels, (II) pest population levels, and (III) associated damage levels. Three inventory-monitoring systems were implemented to quantify this information.

I. Cone and Seed Inventory-Monitoring System (Bramlett and Godbee 1982)

   A. Selection of inventory trees

   Fifteen clones, in the high-medium production class, which had the largest numbers of ramets were selected as inventory trees. The producing orchard is divided into 3 areas based on grafting age. Areas 501, 502, and 503 were grafted in 1965, 1970, and 1972, respectively. The table below lists the selected clone, the number of ramets sampled, and the number of ramets in each area.

Clone	Area 501		Area 502		Area 503	
	No. Ramets (Sampled)	No. Ramets (Area)	No. Ramets (Sampled)	No. Ramets (Area)	No. Ramets (Sampled)	No. Ramets (Area)
B-5-4	1	68	2	153	1	16
B-5-3	1	58	1	166	1	26
B-2-7	1	21	1	91	1	34
B-2-3	1	32	1	128	1	32
M-2-C	1	59	1	76	1	37
C-3-3	1	56	1	92	1	32
A-1-4	1	32	1	114	1	37
A-1-14	1	38	1	26	1	29
A-1-7			3	36		
A-1-9			3	74		
B-1-1			2	18	1	34
B-2-1			2	123	1	34
B-2-4			3	42		
B-4-1			3	96		
B-5-7			3	109		
TOTAL	8	364	27	1,344	10	311

In Area 501, 76% of the ramets were ramets of the clones inventoried. In Area 502, 95% of the ramets were ramets of the clones inventoried. In area 503, 57% of the ramets were ramets of the clones inventoried.

B. Inventory procedures

Prior to conelet closure, all of the female flowers within 1/2 of the tree crown were estimated. This number was doubled and entered on the data sheet as a total tree count.

In March, 8 branches per ramet were tagged with aluminum tags (numbered 1-8) and orange flagging. The number of female flowers and 2nd year cones found on each tagged branch was recorded. These tagged branches were resampled in April, June, August, and September to obtain survival estimates. If a tagged branch no longer contained any flowers or cones, the tag was removed.

II. Pest Population Inventory-Monitoring System

The following are key insect pests causing flower, conelet, and cone damage to loblolly seed sources.

Leptoglossus corculus (Say)	Leaffooted pine seedbug
Tetyra bipunctata (H.-S.)	Shieldbacked pine seedbug
Dioryctria merkeli Mutuura & Munroe	Loblolly pine coneworm
Dioryctria amatella (Hulst)	Southern pine coneworm
Dioryctria clarioralis (Walker)	Blister coneworm
Dioryctria disclusa Heinrich	Webbing coneworm
Family Cecidomyiidae	Cone feeding midges

Currently there are no techniques to predict population trends for any of these pests. A few techniques are available which can detect the presence of certain pests.

A. Pheromone trapping for *Dioryctria* spp.

Pheromone trapping techniques are available for 4 coneworm species, *D. disclusa*, *D. clarioralis*, *D. merkeli*, and *D. amatella*. Because pheromone trapping for these species is a relatively new technique, a standardized trapping scheme has not been developed. In the interim, Forest Service Research recommended using 10 Pherocon 1C® traps baited with each pheromone. Traps were hung with a pulley system from an upper limb located within the top 10 feet of the crown. Twice a week orchard personnel checked the traps and recorded the number of male moths. Baits were changed monthly.

B. Visual searches for *Leptoglossus corculus* and *Tetyra bipunctata*

Attractive trapping methods are not available for either species of seedbug commonly found in seed orchards. Beginning in late March, visual searches were made of all branches sampled during the cone and seed inventory-monitoring system. The number of seedbugs sighted was recorded.

III. Impact Inventory-Monitoring System

Data were gathered, which were used to generate impact estimates, by identifying causes of mortality for cones and conelets inventoried in the cone and seed inventory-monitoring system.

RESULTS AND DISCUSSION

Based upon the cone and seed inventory-monitoring system, approximately 1,564 bushels of the 1983 cone crop were estimated to be present in the loblolly seed source as of September 1982. This estimate represents the survival of 79% of the original estimate made in March 1982. Predictions based on a generalized survival curve indicate that approximately 1,110 bushels of loblolly cones should be harvested in October 1983. Table 1 summarizes these predictions for the 1983 crop.

The following assumptions were used to predict the size of the 1983 cone crop.

1. Sample ramets are representative of all of the ramets of the selected clones.

2. Selected clones represent production levels of unsampled clones.

3. One bushel contains 350 cones.

4. One pound of seed can be extracted from a bushel of cones.

5. Potential estimates are based on the survival of 100% of the flowers or cones from each visit until harvest.

6. Predicted estimates are based on a generalized curve which predicts the crop size expected at maturity when additional mortality occurs (Bramlett 1982).

The orchard production in bushels of cones for the 1983 cone crop is illustrated in figure 1. The dashed line on the graph represents the generalized curve compiled by Bramlett and Godbee (1982) for cone survival in a moderately managed loblolly orchard. The solid line represents the actual cone survival based upon periodic observations of tagged branches.

Table 1. Estimation, based on the inventory-monitoring system, of 1983 loblolly cone crop.

Date	No. Cones	Bushels of Cones	Lbs. of Seed
March 1982			
Potential	693,964	1,983	1,983
Predicted	416,500	1,190	1,190
April 1982			
Potential	551,087	1,574	1,574
Predicted	305,550	873	873
June 1982			
Potential	551,779	1,577	1,577
Predicted	347,200	992	992
August 1982			
Potential	547,423	1,564	1,564
Predicted	374,850	1,071	1,071
September 1982			
Potential	545,381	1,564	1,564
Predicted	388,500	1,110	1,110

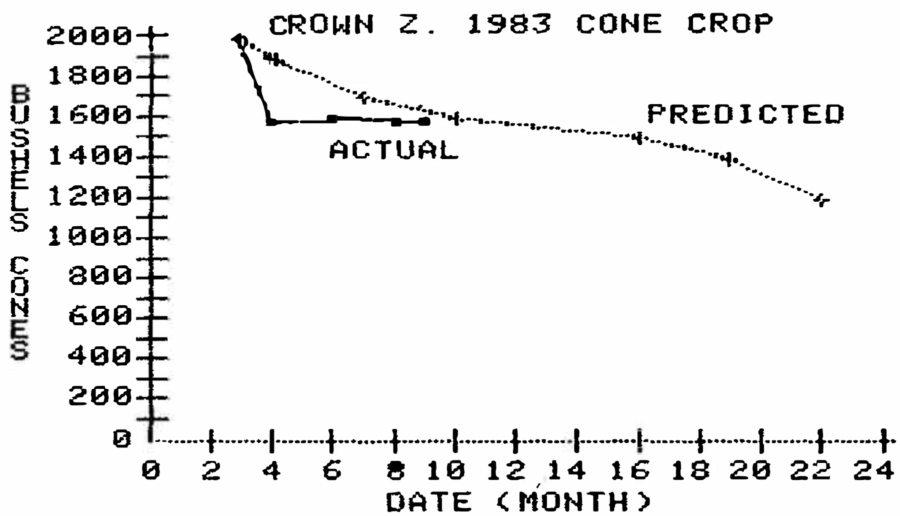

Figure 1. Survival curve of the 1983 cone crop estimated from the cone and seed inventory-monitoring.

Assessment of Key Pest Populations and Impacts

A. Coneworms

Species - *Dioryctria amatella* - southern pine coneworm
D. clarioralis - blister coneworm
D. disclusa - webbing coneworm
D. merkeli - loblolly pine coneworm

Pest Status - In the western zone of the Southern Region, greatest losses due to coneworms are attributed to *D. amatella* and *D. clarioralis*. These pests have multiple generations per year and, therefore, the potential exists for population buildup during the season. In certain orchards spectacular losses have been caused by *D. disclusa*, a single generation pest.

The pheromone trap catches (figure 2) reveal that *D. disclusa* and *D. merkeli* were the species trapped in greatest numbers. The populations of both species are potentially damaging. *Dioryctria amatella* and *D. clarioralis* were present in the orchard, but the trap catches indicated that these species were probably not causing the major 2nd year cone losses.

At the Crown Zellerbach Seed Orchard, shoot attacks may be the earliest visible coneworm damage found during the spring. These attacks are usually attributed to *D. merkeli*, the loblolly pine coneworm, which has only one generation a year. After overwintering as small larvae they move from shoots and flowers to cones. The larvae remain inactive throughout the summer, pupating and emerging in the fall. Dead and dying tips were present on a few trees scattered throughout the loblolly seed source. It is suspected that these tips died from *D. merkeli*, resulting in the mortality percentages indicated in table 2, March to April, under the heading coneworm shoot attacks. During the April to June interval, the numbers of coneworm damaged and dead cones increased from 3.35% (March-April) to 11.36% (April-June). This drastic increase in cone mortality corresponds with the period when *D. merkeli* and *D. disclusa* would be expected to cause substantial losses (table 3).

Dioryctria disclusa overwinters as a small larva and can be found in the male catkins in the spring. If populations are large, webbing becomes very noticeable within the catkins. When the catkins are dry the larvae migrate to the 2nd year cones. The cones die prior to elongation and webbing and frass are present surrounding the entry hole.

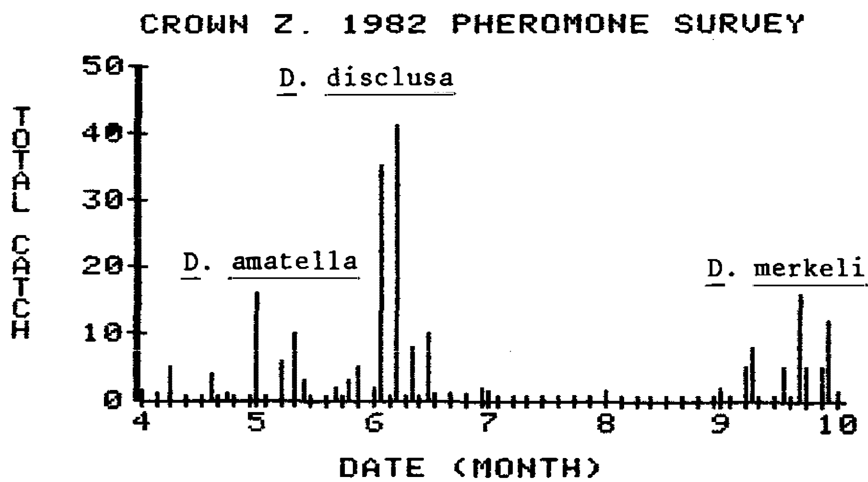

Figure 2. Frequency histogram of the pheromone trap catches of 4 coneworm species (1982).

Table 2. Summary of conelet mortality of the 1983 loblolly cone crop.

Mortality Agents	No. of Dead Conelets		% Mortality	
March - April 1982				
Missing	87,499		12.61	
Unknown	22,334		3.22	
Unknown Insects	21,095		3.04	
Coneworms	7,787		1.12	
Shoot Attacks		7,787		1.12
Abortion	1,022		0.15	
TOTAL	139,737		20.14	
April - June 1982				
Coneworms	4,304		0.78	
Shoot Attacks		2,583		0.47
D. clarioralis		713		0.13
Missing	3,181		0.58	
Unknown	2,091		0.38	
Unknown Insects	946		0.17	
TOTAL	10,522		1.91	
June - August 1982				
Missing	1,640		0.30	
Coneworms	303		0.06	
Shoot Attacks		162		0.03
Unknown Insects	1,284		0.23	
TOTAL	3,227		0.59	
August - September 1982				
Missing	811		0.15	
Unknown Insects	261		0.05	
Tag Lost	296		0.05	
Unknown	882		0.16	
Coneworms	651		0.12	
D. clarioralis		80		0.01
TOTAL	2,901		0.53	

Table 3. Summary of cone mortality of the 1982 loblolly cone crop.

Mortality Agents	No. of Dead Cones		% Mortality	
March - April 1982				
Unknown	45		4.43	
Missing	10		0.98	
Unknown Insects	4		0.39	
Man	1		0.10	
Coneworms	34		3.35	
D. disclusa		1		0.10
Coneworm Damage		14		1.38
TOTAL	94		9.25	
April - June 1982				
Coneworms	105		11.36	
D. disclusa		10		1.08
D. amatella		28		3.03
D. clarioralis		3		0.32
TOTAL	105		11.36	
June - August 1982				
Unknown Damage	7		0.89	
Unknown	3		0.38	
Coneworms	78		9.95	
Coneworm Damage		61		7.78
TOTAL	88		11.22	
August - September 1982				
Missing	1		0.14	
Unknown	1		0.14	
Unknown Damage	3		0.43	
Tag Lost	1		0.14	
Man	1		0.14	
Coneworms	33		4.75	
Coneworm Damage		29		4.15
TOTAL	40		5.74	

Both D. merkeli amd D. disclusa are early spring feeders. These 2 species should be the easiest coneworm species to suppress with Furadan®, however, it appears that during 1982 Furadan did not adequately protect the 2nd year cones. It is difficult to determine the reason for this poor protection. Orchard personnel incorporated the Furadan with a power-till seeder during pollen shed. Rainfall appeared adequate. Furadan did not perform well. It is estimated that Furadan requires 6 weeks in order to reach lethal concentrations. The late Furadan application contributed to the poor performance.

A few D. amatella and D. clarioralis males were captured during April and May. During this period D. amatella was trapped more frequently than D. clarioralis. The coneworm damage which occurred after June (table 3) was probably caused by D. amatella and D. clarioralis. While the damage declined after June, coneworms were still the major mortality agents.

Dioryctria clarioralis, the blister coneworm, overwinters as a large larva and does little or no damage prior to pupating in early spring. The first blister coneworm flight lasted until mid May. The second and third flights were not detectable.

Dioryctria amatella, the southern pine coneworm, overwinters as an early instar larva and begins feeding on male and female flower buds. Later these larvae migrate to shoots or young 2nd year cones where they pupate and emerge. The first generation moth flight was detected by the pheromone traps during April and May. Sporatic catches were made throughout the summer, but flights were not detectable.

Coneworm damage occurred throughout the summer. The majority of the damage occurred prior to June, but unacceptable losses occurred after June.

B. Seedbugs

Species - Leptoglossus corculus (Say) - leaffooted pine seedbug
Tetyra bipunctata (H.-S.) - shieldbacked pine seedbug

Pest Status - The sizes of seedbug populations vary widely among seed orchards. Populations of leaffooted pine seedbugs are considered to be more destructive

than populations of shieldbacked pine seedbugs. Visual estimates indicated that seedbug populations were minimal throughout the summers.

The impact seedbugs will have upon the seed crop will be covered in the post-treatment report.

It is suspected that some of the unknown and missing conelet losses (table 2) found between March and April were caused by seedbug feeding. The greatest conelet losses, 20.14%, occurred during the March to April interval. This is a rather substantial loss and may indicate another area were Furadan did not provide adequate protection. After April conelet losses remained less than 2%.

C. Other pests

No other pests were found in numbers expected to cause damage.

RECOMMENDATIONS

The early season losses of conelets (20%) and cones (23%) indicate that the Furadan application did not provide adequate protection. In order to realize the production goals for 1983, the pest management program must reduce these losses. FPM recommends that significant changes in the pest management strategy should be initiated for the 1983 growing season.

In 1982 D. disclusa and D. merkeli were the key pests of 2nd year cones. Assuming that the same species causing damage in 1982, continue to cause losses in 1983, FPM recommends that the 1983 pest management strategy should consist of a series of pesticide applications (see Appendix I, Alternative 6) applied via aircraft. The following calendar is a suggested spray schedule.

Application	Date	Pesticide
1	6 days after peak pollen shed	Pydrin®
2	2 weeks after appl. #1	Guthion®
3	Mid May	Guthion
4	*Mid June*	*Guthion*
5	*Mid-late August*	*Guthion*
6	Mid-late September	Pydrin

If pest populations are low during midsummer, the applications printed in italics could be eliminated. FPM will continue to assist seed orchard personnel in monitoring damage levels. If cone losses during late May and

early June are less than 5%, FPM will recommend that sprays 4 and 5 be eliminated.

Pydrin should be applied by aircraft at a rate of .75 lbs of active ingredient per acre. This chemical is more suitable for applications during seasons when the probability of rainfall is greatest and when orchard personnel are likely to be in the orchard for prolonged periods. The Guthion applications should be applied by aircraft at a rate of 2 lbs of active ingredient per acre.

Suggested application parameters for fixed-wing and helicopter are listed below.

Parameter	Helicopter	Fixed Wing
Droplet size VMD (microns)	300-350	300-350
Nozzles	50 (D-02-25)	30 (D-06-46)
Boom Pressure (PSIG)	40	40
Speed (MPH)	25	90
Swath Width (ft.)	30	30
Release height above trees (ft.)	5	5
Adjuvant - Nalco-Trol®	3 oz/100 gal H_2O	3 oz/100 gal H_2O

Our experience has shown that many aerial applicators can apply the insecticide with a 60 ft. swath. We have no reason to suspect that an increase in swath width should adversely affect the coverage. With aerial application, approximately 1/3 to 1/2 the active ingredient is applied as compared to a mistblower. The savings in chemicals could help defray additional application costs.

If the Crown Zellerbach Orchard finds that Alternative 6 with aerial application does not meet their needs. FPM recommends the following alternatives in the order listed.

1) Alternative 4 - Aerial application
2) Alternative 4 - Ground application
3) Alternative 5 - Aerial application

Appendix I describes suggested control alternatives.

APPENDIX I

SEED ORCHARD PEST MANAGEMENT CONTROL ALTERNATIVES

Alternative 1. No action.

Benefits:

1) Lowers management costs
2) Encourages the natural buildup of beneficial insects and other predators
3) Reduces exposure of personnel to pesticides
4) Discourages the development of resistant strains of pests

Detriments:

1) Losses must be tolerated for indefinite periods of time
2) Pest populations may build to levels which cannot be tolerated before beneficial insects check the increase

Rationale: This alternative is usually selected when the value of the existing crop is less than the cost of the most inexpensive chemical control measure. As second generation orchards begin producing and as superior seed becomes available in storage, 1st generation orchards, or blocks within these orchards, may be placed on low maintenance. Under a low maintenance program, the "No Action" alternative will become an integral component.

Currently this option is of limited value. Young orchards which have not experienced pest population buildups are probably more efficiently managed without a structured spray program. Very few managers of producing orchards consider this a viable alternative.

Alternative 2. One Furadan® application.

Benefits:

1) Targeted at pests which feed on pine, not at beneficial insects
2) One application may reduce pest populations for several months

Detriments:

1) Furadan 10G has a high oral toxicity and must be incorporated into soil
2) High cost for a single application

3) Translocation is dependent upon adequate soil moisture
4) Efficacy decreases by midsummer
5) Application must be made in late winter or early spring when the ground is frozen or wet

Rationale: This alternative is usually considered for fairly well-drained orchards. Many orchards across the Southeast are too wet in late winter, and the application must be delayed. Applications made after mid-February will not effectively control early season pests. Apparently Furadan provides better protection of conelet crops than it does cone crops. If the flower crop is the featured crop, then a single Furadan application may be an effective strategy.

Orchard managers who have chosen this single application strategy must be willing to accept late season losses.

Alternative 3. Split Furadan application.

Benefits:

1) Targeted at pests which feed on pine, not at beneficial insects
2) One application may reduce pest populations for several months
3) Allows for flexibility in determining when Furadan will be effective

Detriments:

1) Furadan 10G has a high oral toxicity and must be incorporated into soil
2) High application and chemical cost
3) Translocation is dependent upon adequate soil moisture
4) Applications may be delayed because of ground conditions

Rationale: This alternative is usually considered in the same orchard where a single Furadan application would be effective. The treatments should be made approximately 6 weeks before the targeted pests are active or before the previous Furadan concentrations have dropped below the lethal concentration (LC). This alternative may allow you to extend the protection associated with Furadan throughout the growing season. In theory, this alternative has potential. However, the inconsistencies associated with Furadan uptake and translocation probably will make the double application even more inconsistent.

Timing is an important consideration. If the first application is targeted for early season pests then the standard mid-February application will probably be timely for this first application. Furadan usually dissipates by mid to late summer. Therefore, a second application should be applied in late May or early June.

The 2nd important consideration is the application rate. The current label allows for application of from 4-8 oz. of Furadan 10G for each inch of tree diameter. In a split application, two 4 oz. applications should be effective if uptake is sufficient.

Preliminary results indicate that split applications of Furadan used alone do not adequately increase protection over a single application (Overgaard 1976). Additional modifications could be considered but the most important consideration is the benefit:cost of 2 applications as opposed to a single application.

Alternative 4. Three to six sprays of Guthion® or Pydrin®.

Benefits:

1) Multiple sprays allow flexibility in timing applications
2) Frequency of applications can reflect insect damages and/or population levels
3) Flexibility in method of application (ground, air)

Detriments:

1) Labor intensive
2) Excessive exposure of personnel to restricted use pesticide
3) Ground applications may be delayed by excessive soil moisture
4) Residuals from foliar applications are affected by rainfall

Rationale: This alternative allows more responsiveness to insect population levels and flexibility in targeting an application to coincide with the life cycle of the pests. Guthion and Pydrin are the only chemicals currently registered for coneworm control which can be applied monthly, throughout the summer, at the recommended rates. The most widely used formulation of Guthion is the 2S formulation. The 2S formulation does not crystalize when stored below freezing. In addition, the 2S formulation as compared with the WP formulation can be applied with less wear to spraying equipment. However, the WP formulation has a longer residual than the 2S formulation. It may be advantageous to utilize the advantages of each

formulation and use the WP formulation in spring when rainfall is heavy, switching to the less abrasive formulation in the summer and fall. Pydrin is a synthetic pyrethroid with a low mammalian toxicity. Exposure of orchard personnel to Pydrin is much less hazardous. In addition, Pydrin remains at effective concentration for longer periods than Guthion 2S.

The application schedule is extremely important. Applications should be made just prior to the periods when the greatest damages occur. The first spring application usually is made during the week following pollination. This application coincides well with the period when major conelet losses occur and when early coneworm caused losses are beginning. Subsequent sprays are often applied at monthly intervals following the initial spray. If the orchard manager has adequate information to identify and monitor the key pests, then the applications can be targeted for the susceptible stages of the key pests. Currently the technology to monitor and time sprays is limited.

Alternative 5. Furadan combined with supplementary sprays.

Benefits:

1) Insures the orchard is protected during the entire season
2) Increases the suppression efforts against coneworms
3) Early spray applications serve as a backup to Furadan if uptake is minimal

Detriments:

1) Furadan 10G has a high oral toxicity and must be incorporated into soil
2) Translocation is dependent upon adequate soil moisture
3) Application must be made in late winter or early spring when the ground is frozen or wet
4) Labor intensive
5) Ground applications may be delayed by excessive soil moisture
6) Pest management costs are increased substantially
7) Residuals from foliar applications are affected by rainfall

Rationale: This alternative is becoming increasingly popular with industrial orchards. Often the size of the area to be treated is the limiting factor.

If Furadan uptake is sufficient, conelet survival is increased substantially. The highest Furadan concentrations are usually found in the actively growing shoots, making Furadan an ideal

pesticide for early season shoot infesting pests such as tip moths. Furadan appears to be less effective against coneworms, damaging 2nd year cones. Therefore, backup sprays increase the suppression efforts targeted for coneworm control. Both pesticides are usually effective against seedbugs.

The major concern when choosing this alternative is timing the supplementary sprays to obtain maximum protection for the increased management costs. If the orchard has a history of early season pests, particularly 1st generation coneworms (Dioryctria disclusa, etc.), it may be desirable to apply a pesticide 6 days after peak pollen flight. Beginning in mid-May or early June, 2 to 4 additional sprays should protect 2nd year cones against increasing coneworm populations. If cones are harvested using the traditional hand picking procedures, the last spray would probably be applied 2 or 3 weeks before harvest. If netting is used to harvest seed, the last spray can be delayed to suppress increasing populations of both seedbugs and coneworms.

The choice of insecticides is limited. Currently 2 insecticides, Pydrin and Guthion, are registered for coneworm and seedbug control. Pydrin is an ideal chemical for spray applications during periods when orchard personnel are active within the orchard and during periods when a longer residual is needed. Therefore, spring and fall would be ideal times for Pydrin applications while Guthion might be applied in midsummer. This combination of insecticides, Furadan, Guthion, and Pydrin, should help eliminate many of the sucking insect problems associated with the use of Pydrin and Guthion applied by aerial application.

Alternative 6. Three to six sprays of mixed chemicals.

Benefits:

1) Multiple sprays allow flexibility in timing applications
2) Frequency of applications can reflect insect damages and/or population levels
3) Flexibility in method of application (ground, air)
4) Decreased potential for resistant pest populations
5) Less exposure to highly toxic chemicals

Detriments:

1) Labor intensive
2) Excessive exposure of personnel to restricted use pesticide

3) Ground application may be delayed by excessive soil moisture
4) Residuals from foliar applications are affected by rainfall

Rationale: This alternative is very similar to Alternative 4. It is usually advantageous to alternate chemicals rather than to depend on one chemical. Alternate applications of chemicals, with different modes of actions, tend to decrease the development of resistant pest populations. Currently, Pydrin and Guthion are the two registered chemicals which fit well into a spray schedule. Hydraulic, mist blower, and aerial applications of both chemicals have been demonstrated to effectively suppress coneworm and seedbug populations. The characteristics of each chemical have been described under the rationale section of Alternative 5. These characteristics should help determine when each chemical should be applied.

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PRECAUTIONARY STATEMENT

Pesticides used improperly can be injurious to man, animals, and plants. Follow the directions and heed all precautions on the labels.

Store pesticides in their original containers under lock and key out of reach of children and animals, and away from food and feed.

Apply pesticides so that they do not endanger humans, livestock, crops, beneficial insects, fish and wildlife. Do not apply pesticides when there is danger of drift, when honey bees or other pollinating insects are visiting plants, or in ways that may contaminate water or leave illegal residues.

Avoid prolonged inhalation of pesticide sprays or dusts; wear appropriate protective clothing.

If your hands become contaminated with a pesticide, wash them immediately with soap and water. In case a pesticide is swallowed or gets in the eyes, follow the first aid treatment given on the label and get prompt medical attention. If a pesticide is spilled on your skin or clothing, remove the clothing immediately and wash skin thoroughly. After handling or spraying pesticides, do not eat or drink until you have washed with soap and water.

Do not clean spray equipment or dump excess spray material near ponds, streams, or wells. Because it is difficult to remove all traces of herbicide from equipment, do not use the same equipment for insecticides or fungicides that you used for herbicides.

Dispose of empty pesticide containers promptly. Have them buried at a sanitary landfill dump, or crush and bury them in a level, isolated place.

NOTE: Some states have restrictions on the use of certain pesticides. Check your state and local regulations. Also, because registrations of pesticides are under constant review by the U.S. Environmental Protection Agency, consult your county agent, state extension specialist or FPM to be sure it is still registered for the intended use. For further information or assistance, contact Forest Pest Management, Alexandria Field Office, Pineville, La., 71360, (Telephone: FTS 497-7280, or Commercial 318/473-7280).

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BIOLOGICAL EVALUATION OF INSECT DAMAGE AT THE CROWN ZELLERBACH SEED ORCHARD, BOGALUSA. LOUISIANA (1982)

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